PROFESSOR FISHER'S FORMULA FOR ESTIMATING THE VELOCITY OF THE CIRCULATION OF MONEY.

By David Kinley.

The September, 1909, issue of the *Journal of the Royal Statistical Society of London* contains an article by Prof. Irving Fisher on "A Practical Method of Estimating the Velocity of the Circulation of Money," which may, on the whole, fairly be called the most important contribution ever made to the subject. It seems desirable, therefore, to call the attention of American students to the paper and to give the substance of it in a journal accessible to a larger number than is, perhaps, the *Journal of the Royal Statistical Society.* Accordingly, the substance of it is here given and an application of the formula made to somewhat more recent data.

It is not the present purpose of the writer of this note to discuss or criticise Professor Fisher's formula or his reasoning, but simply to give a summary of his article and to apply it to data recently brought together.

Professor Fisher's theorem is that "money deposits [in banks*] plus wages, divided by money in circulation, will always afford a good barometer of the velocity of circulation."

"The total circulation . . . is simply the sum of the annual money flow from and to banks and the money handled by 'non-depositors.' The quotient of this sum divided by the amount of money in circulation will give approximately the velocity of circulation of money." This is his theory in outline, or what he calls his first approximation of the formula.

Classing all people into commercial depositors in banks, other depositors and non-depositors, he points out that there

* Excluding savings banks.

are nine possible kinds of transfers of money for goods as follows:

"The exchanges possible within a class are (1) those between one 'commercial depositor' and another 'commercial depositor'; (2) those between one 'other depositor' and another; and (3) those between one 'non-depositor' and another. The transfers possible between classes are (4 and 5) those between 'commercial depositors' and 'other depositors' in either direction; (6 and 7) those between 'other depositors' and 'non-depositors' in either direction; and (8 and 9) those between 'non-depositors' and 'commercial depositors' in either direction. The three intra-class kinds and the six inter-class kinds make the nine possible kinds of transfers of money against goods."

A formula representing the total circulation, therefore, will be the sum of eight terms, as follows:

$$F = (C_b+O_b+N_b)+(N_c+N_o)$$
$$+(C_o+C_n-B_c)+(C_o+N_o-O_b)+(c+o+n)+(a+g+e)$$
$$+i-B_n$$

= (1) all money deposited.
+ (2) money expenditures of "non-depositors."
+ (3) C's money expenditures from tills (not withdrawn from bank).
+ (4) O's money receipts pocketed (not deposited in bank).
+ (5) intra-class monetary circulation.
+ (6) CN's undiagrammed net outflow of money.
+ (7) CN's net increase of money on hand.
— (8) N's withdrawals of money from bank.

In this formula the various letters C, O, N, etc., stand for the respective classes already described, namely commercial depositors, other depositors, non-depositors, etc. The letter b represents banks. Thus C_b means deposits of commercial depositors in banks; N_o the exchanges between non-depositors and other depositors; B_n the payments of banks to non-depositors, etc. The small letters c, o and n represent intra-class circulation, as described above.

The "net outflow for cashed checks from C and N to O," or the net flow of accommodation checks, enters into the formula and is represented by a. The letter g represents the "net outflow of money given away by the C N group in gifts, taxes, thefts, etc."; while e represents the external outflow from the community by export and losses of all kinds. Finally, i stands for the "net increase of money in the C N group."

The first two terms of this formula are the first approximation already referred to, and the other terms are corrections for sources of circulation not included in the first approximation. The first two terms, Professor Fisher points out, are far the most important, and the last three probably quite negligible. He thinks that in the United States the third, fourth and fifth are probably less than five per cent. of the total.

The first and most important term in the formula is C_b, or the total money deposited in the banks. The statistics of 1896 used by the present writer for reporting to the comptroller in that year on "Substitutes for Money" give $21,400,000 as the total deposits on the settling day nearest July first. Allowing for non-reporting banks, the total retail deposits, both money and credit, for the whole country, were estimated at forty-four millions. Of this total 35.7 million were estimated as the money part of the deposits and may be taken as the daily inflow and outflow of money. Multiplying by 305,* Professor Fisher finds about eleven billions of dollars as the total rate of inflow and outflow of money for the year.

The expenditure of non-depositors (N_c+N_o) is practically the expenditure of wage-earners, and from census returns this total expenditure is estimated at about 4.5 billion. Allowing a billion and a half for expenditure of other non-depositors, we get a total of six billions for all non-depositors. "The first approximation is therefore 11 + 6, or 17 billions."

Adding a small allowance as a correction for omitted factors, Professor Fisher estimates the total circulation of money in the United States in 1896 at about eighteen billion dollars for the year. The money in circulation at the same time was

* Settling days.

$974,000,000 and the velocity is the quotient of the former number divided by the latter, or approximately eighteen times a year.

As Professor Fisher remarks: "In other words, money was kept, on an average, twenty days before it was spent."

It is interesting to apply to Professor Fisher's formula the figures returned in the recent inquiry made into the deposits of banks on the 13th of March last, with a view to determining the present use of credit instruments in business payments.

The first term of the formula is the total money deposits, for the year, of all depositors in all banks except savings banks. In a renewal of the inquiry into the proportion of checks and deposits, made on March 13th, 1909, it has been found, as will appear in the report issued by the Monetary Commission, that specie and currency were deposited in the various classes of banks as follows:

National banks	$25,813,801
State banks	9,439,571
Private banks	629,245
Loan and trust companies	3,446,281

Reports of deposits came from 80 per cent. of the national banks, 41 per cent. of the state banks, 78 per cent. of the private banks and 51 per cent. of the loan and trust companies.

If we should increase the money deposits reported in the proportion of the banks not heard from to the total number, the figures for the various classes of banks would be as follows:

RETAIL DEPOSITS.

National banks	$12,732,000
State banks	11,313,000
Private banks	365,000
Loan and trust companies	2,610,000
Total	$26,509,000

WHOLESALE DEPOSITS.

National banks	$3,656,000
State banks	2,781,000
Private banks	46,000
Loan and trust companies	683,000
Total	$7,166,000

ALL OTHER DEPOSITS.

National banks	$16,389,000
State banks	8,928,000
Private banks	427,000
Loan and trust companies	3,464,000
Total	$29,208,000

This gives a grand total for all classes of deposits $62,883,000.

It is impossible, of course, to get anything like exactness in these figures. For the purpose of determining the total circulation of the country for the year an error of a few millions is, as Professor Fisher points out in his article, a very small amount. A similar error, however, becomes of some consequence when we remember that we have to use the aggregate circulation as a divisor. Our answer giving the number of times a year in which the money of the country turns over is a number of two figures. It may vary several units, therefore, on account of a comparatively small error in the divisor. This must be borne in mind.

However, the above corrected figures for the total estimated deposits of money on the day on which the banks reported to the commission are probably too large. There is reason to think that, while it is proper to add 20 per cent. to the retail deposits of the national banks because 20 per cent. of them did not reply, too great an addition is made when 59 per cent. of the retail returns of the state banks is added, for the state banks not heard from were very likely, in the main, the smallest of their class. A similar remark is applicable to the deposits of the "all others" class. As to corrections for whole-

sale deposits, the probability is very great that of the non-reporting banks only a very small proportion carried wholesale deposits, at all. An error, therefore, is caused by increasing our figures for wholesale deposits for such banks. We would probably be nearer the truth if we added not more than 15 or 20 per cent. for the state banks and loan and trust companies on the wholesale account. As it is impossible, however, to get great accuracy we may perhaps take the estimated total deposits of money on the day in question in round numbers at $60,000,000. Multiplying this number by 305, the number of settling days in the year, we get in round numbers $18,300,000,000, which is the first and most important term of the formula laid down by Professor Fisher.

The second term of the formula is the money payments of non-depositors, made up principally, as Professor Fisher thinks, of the wages of working people. The following table shows an estimate of the increase from 1900 to 1909 in certain pursuits on the basis of the percentage of increase from 1890 to 1900 and on census and railroad returns since 1900. As far as possible salaried officers are eliminated.

	1890.	1900.	Per cent.	1909.
Agricultural pursuits	8,565,926	10,381,765	21.2	12,362,605
Domestic and personal service	4,220,812	5,580,657	32.2	7,377,628
Total				19,740,233
Trade and transportation	1,977,491	2,617,479	35.2	4,275,913
Manufacturing and mechanism	4,251,613	5,208,406		6,935,113
Total				11,211,026

A rough calculation based on the figures of Census Bulletin No. 93 gives us about $550 as the average yearly wages of people in manufacturing. If we should include mechanical pursuits probably the average should be raised a little. Very likely $600 would be more nearly correct for this class.

Again the report of the Interstate Commerce Commission for 1907 gives figures from which it appears that the average yearly wage is about $640. It is more difficult to get a ground for making an estimate of the money wages of those engaged

in agricultural and domestic pursuits. Doubtless it is more than, at first thought, might be believed. The money wages of domestic servants at present probably will average not less than $250 a year. Agricultural laborers are certainly receiving a good deal more than formerly and $300 or $350 probably will not be too large a sum to assign to these. Accordingly, we may recapitulate as follows:

Trade and transportation	4.3	millions at	$640	$2,752 millions.
Manufacturing and mechanical pursuits	6.9	"	" $550	$3,790 "
Agricultural pursuits	12.4	"	" $300	$3,720 "
Domestic and personal service	7.4	"	" $250	$1,850 "
Clerks, etc., having no bank accounts				$1,000 "
Total				$13,112 "

This gives us the second term of the formula. The remaining terms are estimates, an attempt being made to place upper and lower limits on the figures. We thus have the following table:

1st term, money deposited	18.3	billions	±1.90	billions.
2d term, expenditures of non-depositors	13.1	"	±1.13	"
First approximation	31.4	billions	±3.03	billions.
3d term, commercial payments, from till	.50	"	± .50	"
4th term, other depositors' receipts pocketed	.40	"	± .40	"
5th term, inter-class circulation	.40	"	± .40	"
6th term, net undiagrammed outflow from commercial and non-depositors*	.00	"	± .20	"
7th term, net increase of money in commercial and non-depositors	.00	"	± .20	"
8th term, money withdrawn from banks by non-depositors	—.0005	"	± .0005	"
Total	32.6995		±4.7295	

The total circulation outside the treasury on April first last, as given in the monthly report of the treasury department, was about 3,086 millions and the banks had about

* In diagram in original article.

1,368 millions. This leaves 1,718 millions for circulation outside the banks. Dividing the total circulation obtained above, namely, 32.6995, by 1.7, we get about 19 for the number of times a year money turns over. Dividing this into 365 we get the velocity as once in about nineteen days. This is approximately the result shown by the figures of 1896. So great is the latitude of error that we cannot say that there has been any change.